WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

NUCLEAR FIELD DENSITY - MOISTURE TEST FOR RANDOM MATERIAL HAVING LESS THAN 40% OF + 3/4 INCH (+19 mm) MATERIAL

1.0 PURPOSE

1.1 The purpose of this procedure is to determine the density and moisture content of random materials.

2.0 SCOPE

2.1 This method of testing is applicable to random materials used for embankments, subgrades, backfill, and soil cement base courses.

3.0 REFERENCES

3.1 MP 717.04.21
MP 712.21.26
AASHTO T-99, Method C

4.0 EQUIPMENT

4.1 One complete nuclear density-moisture gauge unit meeting the requirements specified in MP 717.04.21. A copy of the manufacturer's print-out of standard counts is to be included.

4.2 One 1/30 ft^3 (0.000943 m^3) proctor mold assembly with a 5.5 LB (2.5 kg) rammer meeting the requirements of AASHTO T-99.

4.3 One steel foundation plate having minimum dimensions of 15 in. x 15 in. x 5/8 in. (380 mm x 380 mm x 16 mm) or a 200 LB (91 kg) block of concrete.

4.4 One extruder for removing specimens from proctor mold.

4.5 One balance having a capacity of at least 10 kg and sensitive to 1.0 g.

4.6 One stove for drying moisture samples.

4.7 One 32 oz. (900 g) ballpeen hammer or equivalent.

4.8 Two pans with a capacity to hold 10 LB (4500 g) of material.

4.9 One pan suitable for drying moisture samples.

4.10 One wire brush

4.11 One 3/4 in. (19 mm) U.S. Standard Sieve

4.12 One scoop

4.13 One ruler or tape measure

4.14 One measuring tape (should be a minimum of 50 ft (15 m))

4.15 One 2 in. (50 mm) approximate size paint brush

4.16 One 18 in. (450 mm) chisel or equivalent

4.17 One draw knife

4.18 Supply of data sheets and attached tables

4.19 One appropriate vehicle for transporting nuclear gauge and test equipment.

5.0 PERSONNEL TRAINING

5.1 All personnel performing the testing must have the minimum training requirements specified in MP 717.04.21.

5.2 All personnel must know and follow the requirements of the Nuclear Regulatory Commission.

6.0 ROUNDING OF DATA

6.1 Test values and calculations are to be rounded according to the following procedure:

6.1.1 If the figure following the last significant number to be retained is larger than five, increase the last significant number to be retained by one.

6.1.2 If the figure following the last significant number to be retained is five, and there are no figures beyond five except zeros, the last significant number to be retained is increased by one if odd, or left unchanged if even.

6.1.3 If the figure following the last significant number to be retained is five and there are figures following the five, the last significant number to be retained is increased by one.

6.1.4 If the figure following the last significant number to be retained is less than five, the significant number is left unchanged.

6.2 Test values and calculations shall be rounded to the following nearest significant digit.

Station Number:	1 ft. (0.1 m)
Offset:	1 ft. (0.1 m)
Lift Thickness:	1/2 in. (10 mm)
Depth Below Grade:	1 ft. (0.1 m)
Dry Density (DA):	1 LB/ft^3 (10 kg/m^3)
Moisture (MA):	1 LB/ft^3 (10 kg/m^3)
Dry Density - 19 mm material (DB):	1 LB/ft^3 (10 kg/m^3)
Moisture (MB):	1%
Excavated Material + Pan (CA):	1 g
Pan (CB):	1 g
Excavated Material (CC):	1 g
+3/4 in. (+19 mm) Material + Pan (CD):	1 g
Pan (CE):	1 g
+3/4 in. (+19 mm) Material (CF):	1 g
+3/4 in. (+19 mm) Material (CG):	1%
Weight of Soil + Mold (PA):	1 g
Mold (PC):	1 g
Weight of Soil (PD):	1 g
Wet Density (PE):	1 LB/ft^3 (10 kg/m^3)
Dry Density (PF):	1 LB/ft^3 (10 kg/m^3)
Wet Weight + Pan (SA):	1 g
Pan (SB):	1 g
Wet Weight (SC):	1 g
Dry Weight + Pan (SD):	1 g
Dry Weight (SE):	1 g

Moisture (SF):	1 g
Moisture (SG):	1%
Optimum Moisture (OA):	1%
Maximum Density (DC):	1 LB/ft^3 (10 kg/m^3)
Relative Density (DE):	1%
Average DE (X):	0.1%
Target (T):	1%
Quality Index (L):	0.01
Within Tolerance (DF):	1%
Minimum Percent for 100% Pay (DG):	1%

7.0 PREPARATION FOR TESTING

7.1 Weigh the pans and proctor mold and record the weights on the sides of the equipment. The weights should be checked at least on a monthly basis.

7.2 All test data is to be recorded on the attached form.

7.3 Standardization of the nuclear gauge

7.3.1 Warm up the gauge for a minimum of 20 minutes.

7.3.2 Standardization of the gauge must be performed away from metal and other objects.

7.3.3 Clean the top of the standard block and the bottom of the gauge with a cloth.

7.3.4 Place the gauge on the standard block with the gauge turned the correct way. For the Troxler 3411 gauge, the scaler end of the gauge must be tight against the standard block flange.

7.3.5 Make the necessary adjustments on the gauge for standardization and take a four minute count for density and moisture.

7.3.6 Compare the standard counts to the manufacturer's standard counts. The standard count must be within ±2% for density and ±4% for moisture from the manufacturer's standards.

7.3.7 If the gauge is not within the specified tolerances for either moisture or density, repeat Section 7.3.5 - 7.3.6. If the gauge will not standardize for either moisture or density after 4 attempts, there is probably something

wrong with the gauge. There may be electronics problems, the gauge needs calibrated, or a stability check needs to be performed. Refer to MP 717.04.21 for a more detailed explanation. In any case, do not use a gauge for testing that will not properly standardize.

7.3.8 When a gauge is used for testing pipe or structure backfill in a trench, first check the standardization of the gauge according to Sections 7.3.1 - 7.3.6. If the gauge is functioning properly, then standardize the gauge in the trench. The standard counts in the trench are used for testing in the trench only and the tolerances would not be applied to the standard counts taken in the trench. When the gauge is moved to a non-trench condition for testing, new standard counts would be required.

7.3.9 Gauges are to be standardized before testing and at least every four hours during testing.

7.4 Record the project number, item number, etc.

7.5 The lot number has the following prefix letter designations based on the use of the material:

Embankment - F
Subgrade - S
Base - B
Pipe and Structure Backfill - P

7.6 Randomly locate the test site according to MP 712.21.26.

8.0 PROCEDURE

8.1 Density and moisture determination

8.1.1 Smooth the test site selected for testing. Fill any voids in the surface using the fines scraped from the surface. Avoid adding excessive fines that would form a build-up on the surface (no more than 1/8 in. (3 mm)).

8.1.2 Place the guide plate on the test site. Next, place the drive rod in the plate guide and while standing on the plate, drive the rod at least 2 in. (50 mm) deeper than the location where the end of the gauge source rod will be when testing. The gauge source rod can be extended in

2 in. (50 mm) increments. The source rod must be as deep as possible within the lift but must not extend beyond the lift. For example, a 5 inch (125 mm) lift would be tested with the source rod in the 100 mm position and the hole would be 8 inch (150 mm) deep. Carefully remove the drive rod to prevent material from falling into the hole.

8.1.3 Place the gauge over the test site and insert the source rod to the desired depth. Pull the gauge tight against the side of the hole toward the scaler. Make sure the gauge is sitting flush on the material.

8.1.4 Take a one minute density and moisture reading. Record the dry density (DA) and moisture (MA).

8.2 Determination of the percent of + 3/4 in. (+3/4 in. (+19 mm)) material

8.2.1 Excavate approximately 4500 g of material immediately beneath the test site. Excavate the material from the test hole toward the scaler end of the gauge and to the depth of the position where the source rod was located. Keep the excavated material covered to prevent moisture loss.

8.2.2 Zero the scales. The scales are to be located in an enclosed area of the vehicle that is protected from air movement. The scales are to be checked for zero before each weighing. Weigh the excavated material (CA).

8.2.3 All of the material weighed in 8.2.2 shall be passed over the 3/4 in. (19 mm) sieve. Break up any clumps of soil that are retained on the sieve and clean the fines from the + 3/4 in. (+3/4 in. (+19 mm)) material.

8.2.4 Weigh the +3/4 in. (+19 mm) material (CD) obtained in 8.2.3.

8.2.5 Calculate the percent of +3/4 in. (+19 mm) material (CG) by using the equations on the form. If the percent of +3/4 in. (+19 mm) material is 40% or more, terminate the test. Refer to MP 717.04.21 for instructions for dealing with the material.

8.2.6 Determine the bulk specific gravity (CH) of the dominant +3/4 in. (+19 mm) material by using the values from the following table:

	Bulk Specific Gravity
Soft Shale:	2.4
Hard Shale:	2.5
Sandstone:	2.5
Gravel:	2.6
Limestone:	2.7
Red Shale (Iron Bearing)	2.7

8.3 Determination of the dry density of the -3/4 in. (-19 mm) material and percent field moisture.

8.3.1 The dry density of the -3/4 in. (-19 mm) material (DB) can be calculated by the equation on the form or obtained from the tables for converting total dry density to density of the -3/4 in. (-19 mm) material. The index with the tables explains how to use the tables.

8.3.2 Calculate the percent field moisture (MB) by the equation on the form.

8.4 One point proctor

8.4.1 Place the proctor mold with collar and base attached on the foundation plate. The foundation plate must be firmly seated so that it does not rock when compacting the material. Mix the -3/4 in. (-19 mm) material obtained in 8.2.3. Form a specimen by compacting the material in the mold in three equal layers (38 mm ± 7 mm). Each layer is compacted by 25 uniformly distributed blows with the metal rammer dropped freely from a height of 305 mm. Stand on the edges of the mold base while compacting the specimen. The rammer must be held vertically.

8.4.2 After the specimen has been made, remove the extension collar. The sample must not extend more than 13 mm above nor be below the top of the mold. A new specimen shall be made if it is too high or low. Carefully trim the material flush with the top of the mold by using the draw knife. Fill any voids in the surface with the fines obtained from the trimming. Use the paint brush to clean

the fines from the outside of the mold. Remove the mold base and by holding the mold vertically, visually check the bottom of the mold to determine if the material extends beyond the mold. Do not turn the mold upside down nor trim the bottom. If the material extends beyond the bottom of the mold, perform another specimen with special precautions to seat and tighten the mold to the base.

8.4.3 Weigh the soil plus mold (PA). Record the values in the first column (left of dashed line) in the one point proctor section.

8.4.4 Remove the specimen from the mold by using the extruder. Place the specimen back in the remaining -3/4 in. (-19 mm) material.

8.4.5 Perform the calculations using the equations on the form to determine the dry density of the one point proctor (PE).

8.5 Determination of the maximum density and optimum moisture

8.5.1 To determine the maximum density and optimum moisture, plot the percent field moisture (MB) and the dry density of the one point proctor (PE) on the maximum density-optimum moisture table (copy attached). The values at the intersection of the density line and moisture column are the maximum density (DC) and optimum moisture (OA). If there are no values given, the sample is either too wet or too dry to determine the maximum density and optimum moisture. When the plotted point is to the right of the maximum densities and optimum moistures, the sample is too wet and when the plotted value is to the left, the sample is too dry.

8.5.2 If the sample is found to be too wet, air dry the -3/4 in. (-19 mm) material to decrease the moisture content between four percentage points below optimum and optimum moisture. The sample is dried by spreading the sample on a sheet of metal, canvas, etc. Do not dry the sample on a stove. If the sample is too dry, add water to increase the moisture content to the above moisture range. Care should be taken not to over dry or add too much water to the sample.

8.5.3 Rerun one point proctor

8.5.3.1 Once the sample has been air dried or water added, thoroughly mix the sample and perform another one point proctor according to 8.4.1 - 8.4.4. Record the data in the second column (right of dashed line) in the one point proctor section.

8.5.3.2 Calculate the wet density of the rerun one point proctor (PE) by using the equations on the form.

8.5.4 Stove dried moisture

8.5.4.1 Scoop out a representative sample between 200 g and 400 g from the sample in 8.5.3.1. The moisture determination can be made in conjunction with making the rerun one point proctor specimen. Place the sample in the pan for drying samples and determine the sample weight plus pan (SA).

8.5.4.2 Adjust the stove flame to a low heat so that the sample will not oxidize during drying. Occasionally stir the sample and be very careful not to lose any of the sample. Once the sample appears dry, weigh the sample and record the weight. Place the sample back on the stove and dry for approximately two minutes. Weigh the sample and compare the two weights. The weights should be the same (constant). If there is a decrease in weight, reheat the sample again for two minutes and weigh. Continue this process until two consecutive weighings are the same and this weight is dry weight plus pan (SD).

8.5.4.3 By using the equations on the form, calculate the percent moisture (SG).

8.5.5 Use the percent moisture (SG) from the stove dried moisture to calculate the dry density of the rerun one point proctor (PE).

8.5.6 Plot the dry density of the rerun one point proctor (PE) and the percent stove dried moisture (SG) on the maximum density-optimum table to obtain the maximum density (DC) and the optimum moisture (OA).

9.0 MOISTURE EVALUATION

9.1 Obtain the ± moisture tolerance (OB) from the project's governing specifications.

9.2 To determine the acceptable moisture range, add the plus tolerance and subtract the minus tolerance from the optimum moisture. The field moisture (MB) must be within this range for the moisture to meet specifications. If the moisture fails specifications, corrective action is required.

10.0 DENSITY EVALUATION

10.1 Calculate the percent relative density (DE) by the equation on the form.

10.2 If the percent relative density (DE) is 105 or more, the test results may be in error. Plot the dry density of the -3/4 in. (-19 mm) material (DB) and the percent field moisture (MB) on the maximum density-optimum moisture table to check the validity of the test results. The plotted point should fall on or to the left of the darkened blocks (zero air voids). Another method of checking the test results is to calculate the maximum moisture content possible (zero air voids) by the following equation:

Maximum moisture content possible (English) = (62.4/DB - .373)100

Maximum moisture content possible (Metric) = (1000/DB - 0.373)100

When the test results are equal to or less than the above evaluation, the results are acceptable.

10.3 When the conditions in 10.2 are not met, perform another complete test, including a one point proctor, at a new random location. The checks in 10.2 would again be made if the test results are 105% or more. If the conditions in 10.2 are still not met, obtain a sample and determine the specific gravity of both the +3/4 in. (+19 mm) and -3/4 in. (-19 mm) material, performed separately. Then recalculate the test results using the specific gravity of the +3/4 in. (+19 mm) material to determine the dry density of the -3/4 in. (-19 mm) material (DB). If the percent relative density is still 105% or more, perform the following calculation using the specific gravity of the -3/4 in. (-19 mm) material.

Maximum moisture content = (62.4/DB - 1/Sp. Gr.)100

Maximum moisture content = (1000/DB - 1/Sp. Gr.)100

The field moisture (MB) must be equal to or less than the maximum moisture content (new zero air voids). If the test results still appear to be invalid, an immediate investigation must be conducted.

11.0 LOT EVALUATION

11.1 Five tests are required for a lot evaluation. Each test shall be performed according to previous sections of this procedure.

11.2 Calculate the average relative density (x) for the five tests in the lot.

11.3 Obtain the target percentage of dry density (T) from the project's governing specifications.

11.4 Determine the range (R) of the relative densities (DE) by subtracting the smallest value from the largest.

11.5 Calculate the quality index (QL) by using the equation on the form.

11.6 Enter the table for estimating the percent of a lot within tolerance (copy attached). Determine the percent within tolerance (DF) which corresponds to the QL value calculated in 11.5 above.

11.7 Obtain the minimum percent for 100% pay (DG) from the project's governing specifications.

11.8 In order for a lot to meet specifications for density, the percent within tolerance (DF) must be equal to or greater than the percent for 100% pay (DG). Corrective action is required to bring a failing lot into specification requirements.

12.0 GENERAL REQUIREMENTS

12.1 In order for a lot to meet specifications, the requirements in 9.2 and 11.8 must be met.

12.2 The maximum density, optimum moisture, and percent of +3/4 in. (+19 mm) material may be used for subsequent tests in a lot if the -3/4 in. (-19 mm) material does not change. When the material changes, the determination of new control data is required. There must be at least one, one point proctor, for each lot.

12.3 If the test results indicate that the material meets specifications and the material exhibits pumping or displacing action under the weight of construction equipment, the test results are probably in error. Obtain a sample of the material and determine the maximum density and optimum moisture according to AASHTO T99, Method C. Until the laboratory test results are obtained, the material in question would be dried and recompacted until the pumping stops. The area would then be retested and this moisture content used as the upper limit for moisture during the interim period.

12.4 During the compaction of soil cement base course, if the material starts to shear, cease rolling even though the required specifications for compaction are not met. The material is accepted for compaction and the proper documentation in the project's records would be made.

12.5 Independent tests for similarity checks can be recorded on the form. Use only the applicable sections of the form.

Robert K. Tinney, Director
Contract Administration Division

RTK:Sra

Attachments

MP 207.07.20
ATTACHMENT 2

TABLE FOR ESTIMATING PERCENT OF LOT WITHIN TOLERANCE

Quality Index (QL) Positive Values	Percent Within Tolerance
.66	99
.65	98
.62	97
.60	96
.58	95
.57	94
.55	93
.53	92
.51	91
.50	90
.48	89
.46	88
.45	87
.44	86
.42	85
.41	84
.40	83
.38	82
.37	81
.36	80
.34	79
.33	78
.32	77
.30	76
.29	75
.28	74
.27	73
.25	72
.24	71
.23	70
.22	69
.21	68
.19	67
.18	66
.17	65
.16	64
.15	63
.14	62
.13	61
.11	60
.10	59
.09	58
.08	57
.07	56
.06	55
.05	54
.04	53
.02	52
.01	51
.00	50

Quality Index (QL) Negative Values	Percent Within Tolerance
.00	50
.01	49
.02	48
.04	47
.05	46
.06	45
.07	44
.08	43
.09	42
.10	41
.11	40
.13	39
.14	38
.15	37
.16	36
.17	35
.18	34
.19	33
.21	32
.22	31
.23	30
.24	29
.25	28
.27	27
.28	26
.29	25
.30	24
.32	23
.33	22
.34	21
.36	20
.37	19
.38	18
.40	17
.41	16
.42	15
.44	14
.45	13
.46	12
.48	11
.50	10
.51	9
.53	8
.55	7
.57	6
.58	5
.60	4
.62	3
.63	2
.66	1

MP207.07.20
ATTACHMENT NO. 3

MAXIMUM DENSITY-OPTIMUM MOISTURE TABLE

DRY DENSITY OF ONE POINT PROCTOR

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
130			131 9	130 9																
129		131 9	130 9	129 9																
128		130 9	130 9	128 10																
127	131 9	130 9	128 10	127 10	127 10															
126	131 9	130 9	128 10	127 10	126 10															
125	130 9	128 10	127 10	126 10	125 10															
124		128 10	126 10	125 11	125 11	124 11														
123		127 10	126 10	124 11	123 11	123 11														
122		126 10	125 11	124 11	123 11	122 12														
121		126 11	125 11	123 12	122 12	121 12	121 12													
120		125 11	124 11	122 12	121 12	120 12	120 12													
119			123 12	122 12	120 12	120 12	119 13													
118			122 12	120 12	120 12	119 13	118 13	118 13												
117				120 12	119 13	118 13	117 13	117 13												
116				119 13	118 13	117 13	117 13	116 14												
115				118 13	117 13	116 14	116 14	115 14	115 14											
114				117 13	116 14	116 14	115 14	114 14	114 14											
113					116 14	115 14	114 14	114 14	113 15											
112					115 14	115 14	113 15	113 15	112 15	112 15										
111					115 14	113 15	112 15	112 15	111 15	111 16										
110					113 15	112 15	112 15	111 15	111 16	110 16										
109						112 15	111 16	110 16	110 16	109 16	109 16									
108						111 16	110 16	110 16	109 16	109 17	108 17									
107							110 16	109 17	108 17	108 17	107 17	107 17								
106							109 17	108 17	107 17	107 17	106 18	106 18								
105							108 17	107 17	107 17	106 18	106 18	105 18	105 18							
104								107 17	106 18	105 18	105 18	104 19	104 19							
103								106 18	105 18	105 19	104 19	103 19	103 19	103 19						
102								105 18	105 19	104 19	103 19	103 20	102 20	102 20	102 20					
101									104 19	103 19	102 20	102 20	101 20	101 20	101 21					
100									103 19	102 20	101 20	101 21	100 21	100 21	100 21	100 21				
99									102 20	101 20	101 21	100 21	100 21	99 21	99 22	99 22				
98										100 21	100 21	99 21	99 22	98 22	98 22	98 22	98 22			
97										100 21	99 21	99 22	98 22	98 22	98 22	97 22	97 23			
96											99 22	98 22	98 22	98 22	97 23	97 23	96 23			
95											99 22	98 22	97 23	97 23	96 23	95 24	95 24	95 24		
94											98 22	97 23	96 23	95 24	95 24	95 24	94 24	94 24	94 24	
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

PERCENT MOISTURE

MP207.07.20
ATTACHMENT NO. 4

MAXIMUM DENSITY-OPTIMUM MOISTURE TABLE

DRY DENSITY OF ONE POINT PROCTOR

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1790	1850 14	1830 14	1810 15	1800 15	1790 15	1790 15									
1780	1840 14	1820 15	1810 15	1790 15	1790 15	1780 15									
1770	1820 14	1810 15	1800 15	1780 15	1780 16	1770 16									
1760	1810 15	1800 15	1790 15	1780 16	1770 16	1760 16									
1750		1790 15	1780 15	1770 16	1760 16	1750 16	1750 16								
1740		1790 15	1770 16	1760 16	1750 16	1750 16	1740 17								
1730		1780 15	1770 16	1760 16	1750 16	1740 17	1730 17								
1720			1760 16	1750 16	1740 17	1730 17	1720 17	1720 17							
1710			1750 16	1740 17	1730 17	1720 17	1720 17	1710 17							
1700			1750 16	1730 17	1720 17	1710 17	1710 17	1700 18							
1690			1740 17	1720 17	1720 17	1710 18	1700 18	1690 18	1690 18						
1680			1730 17	1720 17	1710 17	1700 18	1690 18	1680 18	1680 18						
1670			1720 17	1710 17	1700 18	1690 18	1680 18	1680 18	1670 19						
1660				1710 18	1700 18	1680 18	1670 19	1670 19	1660 19	1660 19					
1650				1700 18	1690 18	1680 18	1670 19	1660 19	1650 19	1650 19					
1640				1690 18	1680 18	1670 19	1660 19	1650 19	1640 19	1640 19					
1630				1680 18	1670 19	1660 19	1650 19	1640 20	1630 20	1630 20	1630 20				
1620					1660 19	1650 19	1640 20	1630 20	1630 20	1620 20	1620 20				
1610					1650 19	1640 20	1630 20	1620 20	1620 21	1610 21	1610 21				
1600					1650 20	1630 20	1620 20	1610 21	1610 21	1600 21	1600 21	1600 21			
1590					1640 20	1630 20	1620 21	1610 21	1600 21	1600 21	1590 21	1590 21			
1580					1630 20	1620 20	1610 21	1600 21	1590 21	1580 22	1580 22	1580 22			
1570						1610 21	1600 21	1590 21	1590 22	1580 22	1580 22	1570 22	1570 22		
1560						1600 21	1590 21	1590 22	1580 22	1570 22	1570 22	1570 22	1560 22		
1550						1600 21	1590 22	1580 22	1570 22	1570 22	1560 23	1560 23	1550 23		
1540						1590 21	1580 22	1580 22	1570 22	1560 22	1550 23	1550 23	1540 23	1540 23	
1530							1580 22	1570 22	1570 22	1550 23	1540 23	1530 23	1530 23	1530 23	
1520							1570 22	1570 22	1560 23	1540 23	1530 23	1530 24	1520 24	1520 24	
1510							1570 22	1560 22	1550 23	1530 23	1520 24	1520 24	1510 24	1510 24	1510 24
1500							1570 22	1560 23	1530 23	1520 24	1510 24	1510 24	1500 24	1500 25	1500 25
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

PERCENT MOISTURE

MP207.07.20
ATTACHMENT NO. 4

MAXIMUM DENSITY-OPTIMUM MOISTURE TABLE

DRY DENSITY OF ONE POINT PROCTOR

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2080			2090 9	2080 9											
2070		2100 9	2080 9	2070 9											
2060		2090 9	2080 9	2060 10											
2050		2090 9	2070 9	2050 10											
2040		2090 9	2060 10	2050 10	2040 10										
2030	2100 9	2080 9	2050 10	2040 10	2030 10										
2020	2100 9	2080 9	2050 10	2030 10	2020 10										
2010	2090 9	2070 9	2040 10	2030 10	2010 10										
2000	2090 9	2060 10	2030 10	2020 10	2000 11										
1990		2050 10	2030 10	2010 11	2000 11	1990 11									
1980		2040 10	2020 10	2000 11	1990 11	1980 11									
1970		2040 10	2020 10	2000 11	1980 11	1970 11									
1960		2030 10	2010 11	1990 11	1970 11	1960 12									
1950		2020 10	2000 11	1980 11	1960 12	1950 12									
1940		2020 10	2000 11	1970 11	1950 12	1940 12	1940 12								
1930		2010 11	1990 11	1980 12	1950 12	1940 12	1930 12								
1920		2010 11	1980 11	1960 12	1940 12	1930 12	1920 12								
1910			1970 11	1950 12	1930 12	1920 12	1910 13								
1900			1960 12	1940 12	1920 12	1910 13	1900 13								
1890			1950 12	1930 12	1910 12	1900 13	1890 13								
1880				1920 12	1910 13	1890 13	1890 13	1880 13							
1870				1910 13	1900 13	1880 13	1880 13	1870 13							
1860				1900 13	1890 13	1880 13	1870 13	1860 14							
1850				1900 13	1880 13	1870 13	1860 14	1850 14							
1840				1890 13	1870 13	1860 14	1850 14	1840 14	1840 14						
1830				1880 13	1870 13	1860 14	1850 14	1840 14	1830 14						
1820				1870 13	1860 14	1850 14	1840 14	1830 14	1820 14						
1810					1860 14	1850 14	1830 14	1820 14	1810 15						
1800					1850 14	1840 14	1820 14	1810 15	1800 15						
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

PERCENT MOISTURE

TABLES FOR CONVERTING

TOTAL DRY DENSITY TO DENSITY

OF THE -3/4 in. (-19 mm) MATERIAL

INSTRUCTIONS FOR USING THE TABLES

To use the tables, locate in the index the page number corresponding to the specific gravity (CH), the total dry density (DA), and the percent of +3/4 in. (+19 mm) material (CG). Turn to the selected page and locate the total dry density in the left column and read across the page to the column corresponding to the percent of +3/4 in. (+19 mm) material. The percents of +3/4 in. (+19 mm) material are listed across the top of the page. The value at the intersection is the dry density of the -3/4 in. (-19 mm) material (DB).

EXAMPLE:

Given: Specific Gravity = 2.5
Percent of +3/4 in. (+19 mm) material = 29
Total Dry Density = 1 970 kg/m^3

Turn to the index with the values and select Page 20. Next, turn to Page 20 and notice that a specific gravity of 2.5 is listed at the top of the page. Read down the left column and locate 1 970 kg/m^3. Then read across the page to the column corresponding to 29%. The value of 1 880 kg/m^3 at the intersection is the dry density of the -3/4 in. (-19 mm) material.

INDEX

PERCENT OF +3/4 in. (+19 mm) MATERIAL	TOTAL DRY DENSITY	PAGE NUMBER
Specific Gravity of 2.4		
1 - 10	1280 - 1770	1
1 - 10	1780 - 2260	2
1 - 10	2270 - 2560	3
11 - 20	1280 - 1770	4
11 - 20	1780 - 2260	5
11 - 20	2270 - 2560	6
21 - 30	1280 - 1770	7
21 - 30	1780 - 2260	8
21 - 30	2270 - 2560	9
31 - 40	1280 - 1770	10
31 - 40	1780 - 2260	11
31 - 40	2270 - 2560	12
Specific Gravity of 2.5		
1 - 10	1280 - 1770	13
1 - 10	1780 - 2260	14
1 - 10	2270 - 2560	15
11 - 20	1280 - 1770	16
11 - 20	1780 - 2260	17
11 - 20	2270 - 2560	18
21 - 30	1280 - 1770	19
21 - 30	1780 - 2260	20
21 - 30	2270 - 2560	21
31 - 40	1280 - 1770	22
31 - 40	1780 - 2260	23
31 - 40	2270 - 2560	24
Specific Gravity of 2.6		
1 - 10	1280 - 1770	25
1 - 10	1780 - 2260	26
1 - 10	2270 - 2560	27
11 - 20	1280 - 1770	28
11 - 20	1780 - 2260	29
11 - 20	2270 - 2560	30
21 - 30	1280 - 1770	31
21 - 30	1780 - 2260	32
21 - 30	2270 - 2560	33
31 - 40	1280 - 1770	34
31 - 40	1780 - 2260	35
31 - 40	2270 - 2560	36
Specific Gravity of 2.7		
1 - 10	1280 - 1770	37
1 - 10	1780 - 2260	38
1 - 10	2270 - 2560	39
11 - 20	1280 - 1770	40
11 - 20	1780 - 2260	41
11 - 20	2270 - 2560	42
21 - 30	1280 - 1770	43
21 - 30	1780 - 2260	44
21 - 30	2270 - 2560	45
31 - 40	1280 - 1770	46
31 - 40	1780 - 2260	47
31 - 40	2270 - 2560	48